



Overview of SEFSC Bycatch Reduction Research

Southeast Fisheries Science Center
Mississippi Laboratories
Harvesting Systems Unit





SEFSC Gear Research Guidance

SEFSC Sea Turtle Strategic Plan

- Development of bycatch mitigation technologies to reduce potential protected species population impacts from fishery interactions
- Develop and refining modifications to fishing gear and practices that can reduce sea turtle bycatch without implementing fishery closures
- Inform amendments to fishery regulations pertaining to modified gear or practices and train enforcement personnel
- Conduct training to ensure proper use of gear by fishers



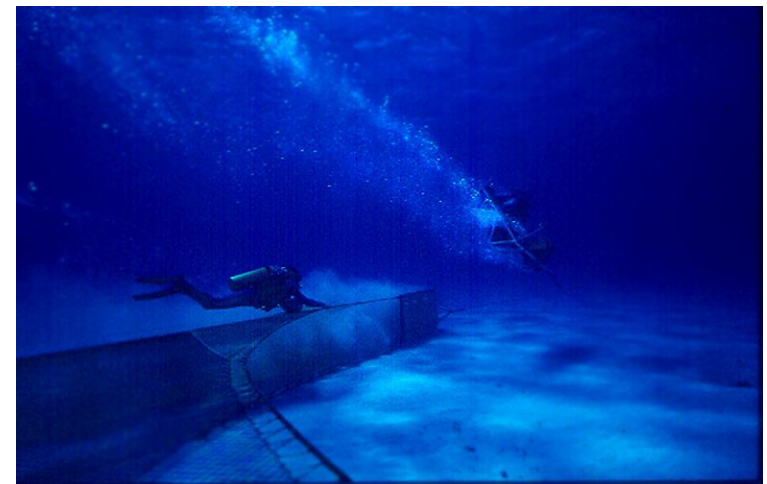
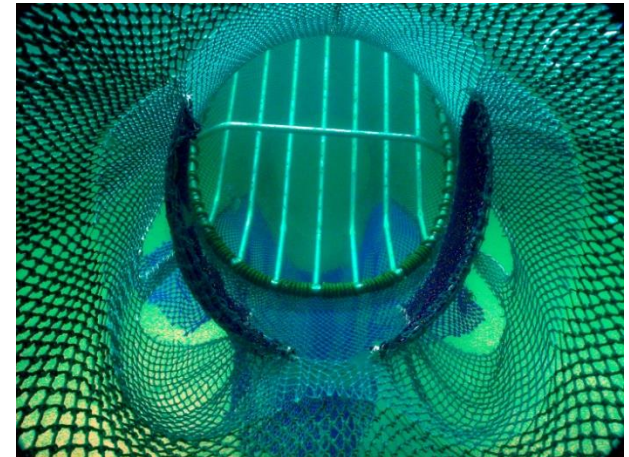
SEFSC Gear Research Guidance

- Magnuson-Stevens Fishery Conservation and Management Act; National Standard 9; Bycatch
- Marine Turtle Conservation Act (2004)
- NMFS Strategic Plan, SEFSC Strategic Plan
- 2014 Biological Opinion Southeast U.S. Shrimp Fisheries
- NMFS Bycatch Reduction Engineering Program
 - Participate as SEFSC representative
 - Develop national priorities for bycatch reduction research
 - Direct funding to internal (NMFS) and external bycatch reduction researchers



SEFSC Harvesting Systems Unit Background

- Unique mission within NOAA Fisheries
- Gulf of Mexico, SE Atlantic & International
- 4 - Research fisheries biologists
3 - Gear specialists
- Fisheries: Trawl, Longline, Gillnet
- Specialized techniques
 - SCUBA
 - Autonomous U.W. cameras
 - High resolution sonar





SEFSC Gear Research

Fishery	Species	Research
Trawl (shrimp, flounder, flynet)	turtles	TEDs
Gillnet	turtles / sturgeon	Low profile, lights, modified panels
Longline	turtles	Circle hooks, bait type, soak time
Trawls (shrimp)	mammals	Behavior assessment



Research Methods

Fishery-Dependent Research

- At-sea testing and evaluation aboard commercial vessels
- Assess usability of new gear concepts
- Evaluate effects on target catch



Fishery-independent research

- Proof of concept evaluations aboard NMFS R/Vs
- Using advanced technology to:
 - Evaluate gear dynamics
 - Understand fish and marine animal behavior relative to gear





Approving new TEDs: Juvenile turtle testing protocol

Controlled test using NOAA divers and captive-reared, 2-yr old loggerheads

Candidate TEDs are certified through the protocol, which was published and has been in use since 1990
(FR Vol. 55, No. 195)

Provides opportunity for industry and researchers to evaluate new ideas

Resulted in significant improvements in TED performance with regard to turtle exclusion and shrimp retention



Recent Research: Skimmer Trawl TEDs

Small Turtle Exclusion Rate Evaluations

Captive-reared, one year old, loggerhead sea turtles are used as surrogates for Kemp's ridleys caught in the fishery to determine exclusion rates for various TED configurations.



Independent Catch Retention Testing

Suitable TED configurations identified through small turtle evaluations are tested under commercial conditions aboard NOAA vessel *RV Caretta* to determine levels of shrimp loss and bycatch reduction associated with each.



Dependent Catch Retention Testing

TED configurations that exhibit minimal shrimp loss during independent testing are further tested under various commercial conditions aboard multiple commercial vessels throughout the southeastern skimmer trawl fishery.



Flynet TED Research

Challenges Transferring TED Technology

High Catch Rates

Flynets are high opening bottom trawls utilized to target various species of finfish including Atlantic croaker. Catch rates may exceed 20,000 lbs in 30 minutes.

Gear Storage on Net Reels

Nets and associated gear are deployed, retrieved and stored on stern mounted net reels, which does not lend to the use of rigid frame TEDs.

Handling and Long-Term Durability of Gear

Large catches combined with rough seas require TED designs that are virtually “hands-free” and extremely durable.



Flynet TED Research

TED Design and Development

Design development

Multiple prototypes evaluated with research focused on flexible designs.

Three Pronged Approach

Prototype designs are evaluated for:

Turtle Exclusion – Small turtle testing certification

Usability – Installation and use in standard commercial gear

Catch Retention – Trouser trawl or alternate haul

Certified Designs

Flexible Flatbar Flynet (FFF) TED – Contains a flexible center section with target catch reduced by 3.9%

Hopkins Cable TED – Constructed completely of cable, scheduled for catch retention testing fall 2015.

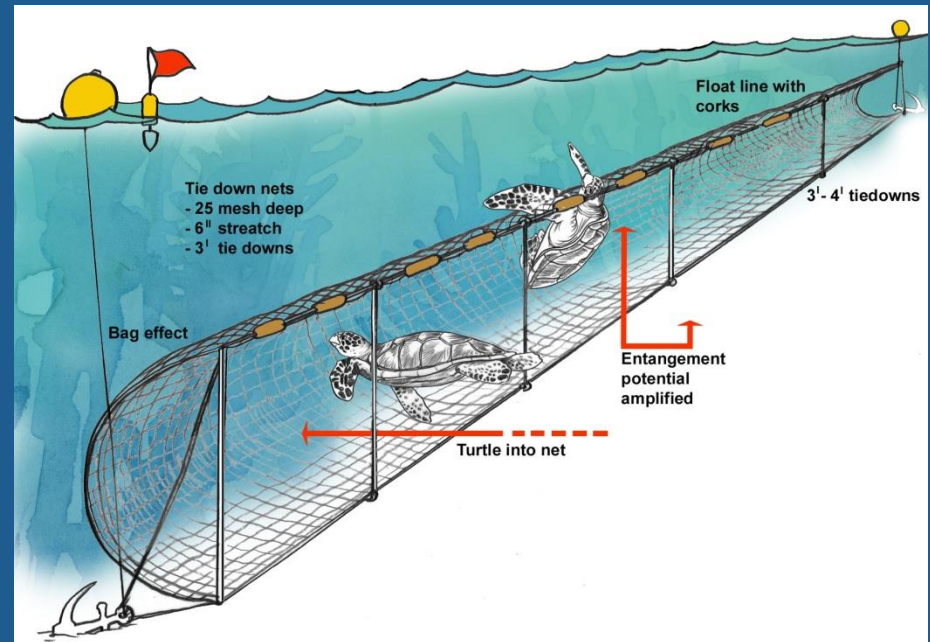


Gillnet Research

Overview of Experimental Gillnet Research – 2001 – 2014

Modifications Assessed:

- Low Profile Gillnets (NC, Trinidad)
- Double Lead line Gillnets (NC)
- Modified Panel Gillnets (VA)
- Lighted Gillnets (NC)



Gillnet Research

Purpose/Methods

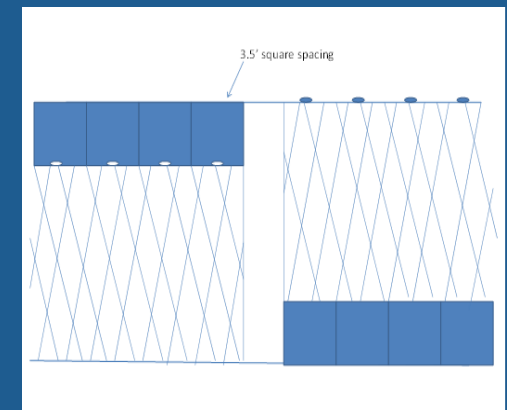
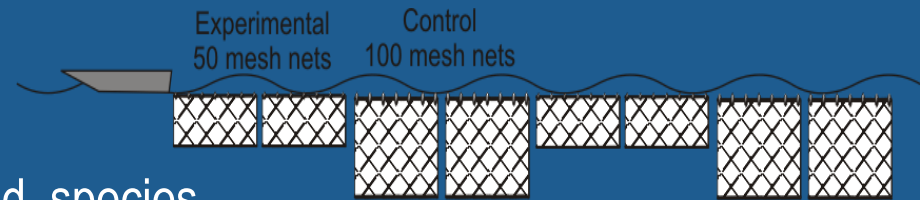
Tested modified gillnets to reduce protected species interactions

Species of concern included sea turtles, sturgeon and other finfish bycatch

Experiments conducted in NC, VA, and Trinidad in estuarine and nearshore waters

Matched paired sets between control and experimental nets

Studies were conducted both independently and dependently



Gillnet Research

Results

Low profile gillnets proved effective (38%, 80% reductions in sea turtles) in Trinidad and NC

Modified panels (3.5' openings) reduced sturgeon by 64%, and increased striped bass 46%

Double lead line and gillnet light studies were inconclusive due to area tested in NC

Gillnet Research

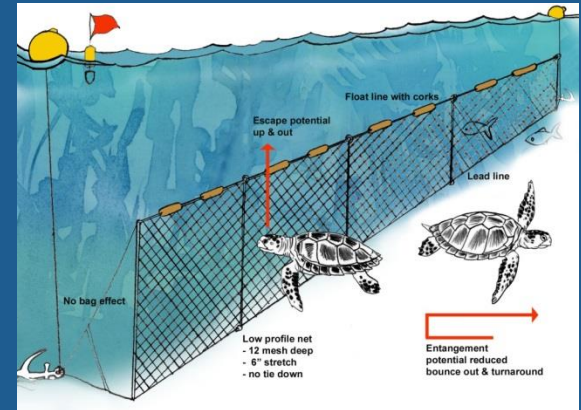
Key Points / Future Research

Tie-downs in gillnets increase entanglement and potential mortality

If target catches can be maintained, less webbing in the water column is desirable

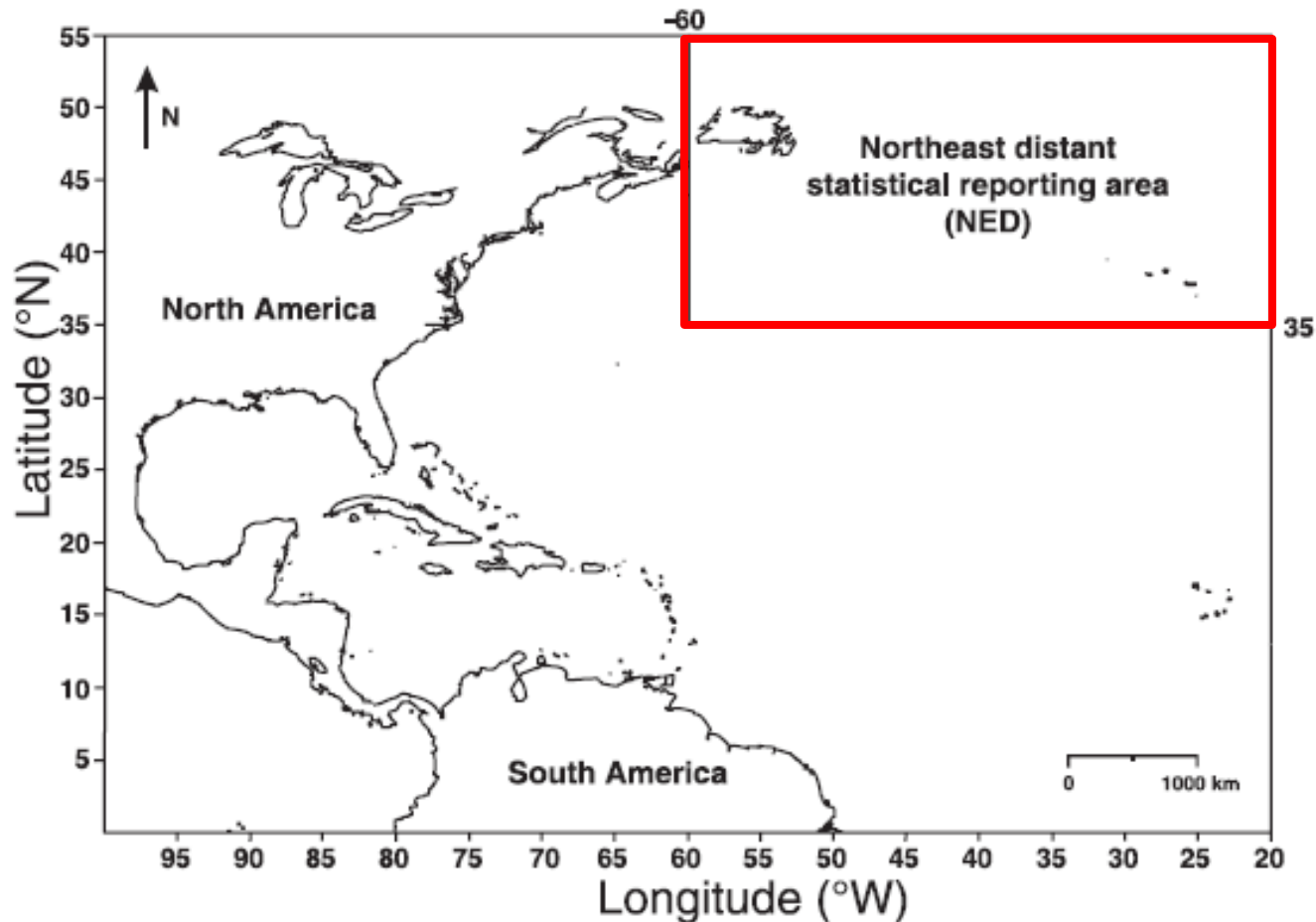
No one-size fits all net configuration; varies by depth, fishery, location

Continued research with lighted gillnets, rectangular mesh, and double lead line needed



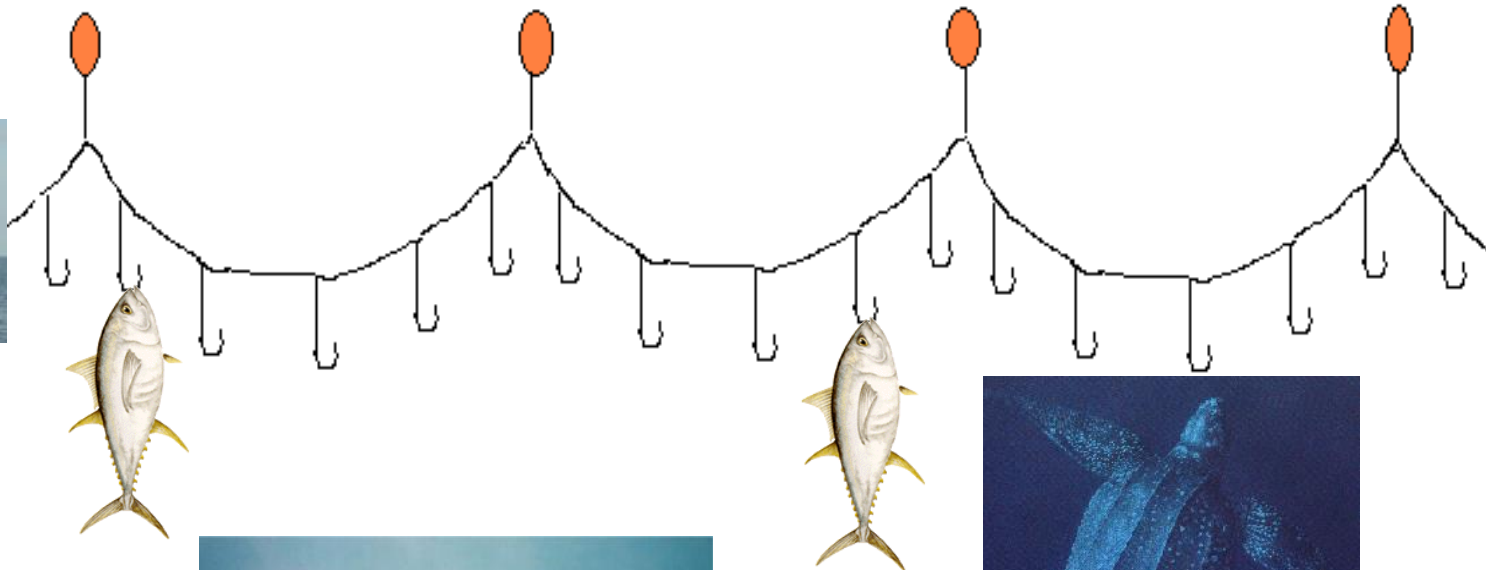


Sea Turtle Bycatch Experiment Northeast Distant Waters Swordfish Fishery 2001-2003





Pelagic Longline Sea Turtle Bycatch



Hard-shelled turtles
mouth hooked



Leatherback turtles
generally entangled
or foul hooked



Sea Turtle Bycatch Experiment NED Swordfish Fishery 2001-2003

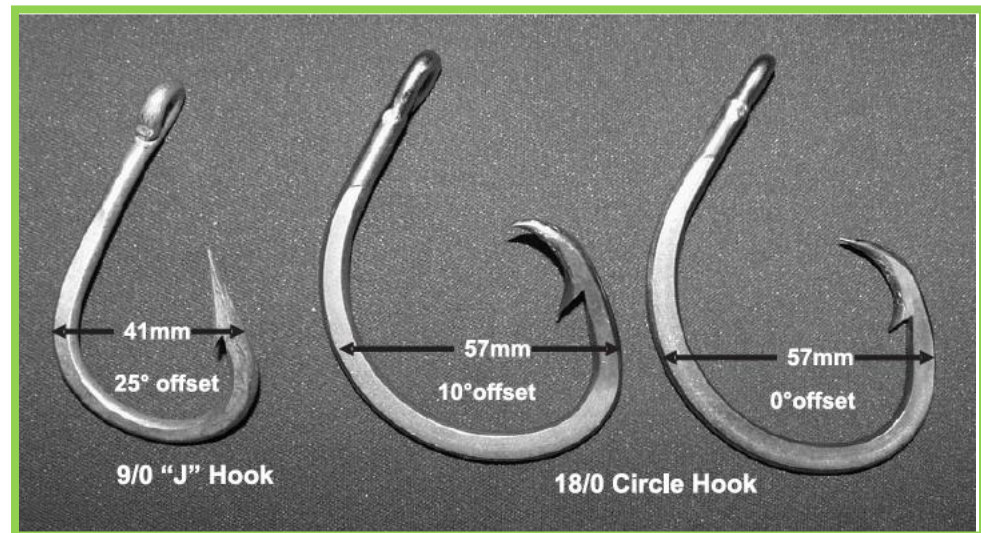
Bait Type:

Fish vs. Squid



Hook Type:

J-hook vs. circle hook





Optimal Combination For Sea Turtle Mitigation



Mackerel bait



18/0
Circle Hook

Sea Turtle Bycatch Experiment Results

	% Difference
Loggerhead Turtles	- 88% (reduction)
Leatherback Turtles	- 63% (reduction)
Swordfish	+ 20% (increase)
Bigeye Tuna	- 80% (reduction)

Watson. et al. 2005. Fishing methods to reduce sea turtle mortality associated with pelagic longlines. Can. J. Fish. Aquat. Sci. 62: 965-981.



Weak Hook Experiment Results

- 8 commercial vessels involved in tests
- 418 pelagic longline sets completed
- 134 bluefin were caught during the experiment
- 47 caught on the experimental hook
- 46% reduction in bluefin with weak hooks
- 2,547 yellowfin tuna landed
- 6% reduction in yellowfin catch (ns)
- Majority of bluefin escapes took place in < 5 min.





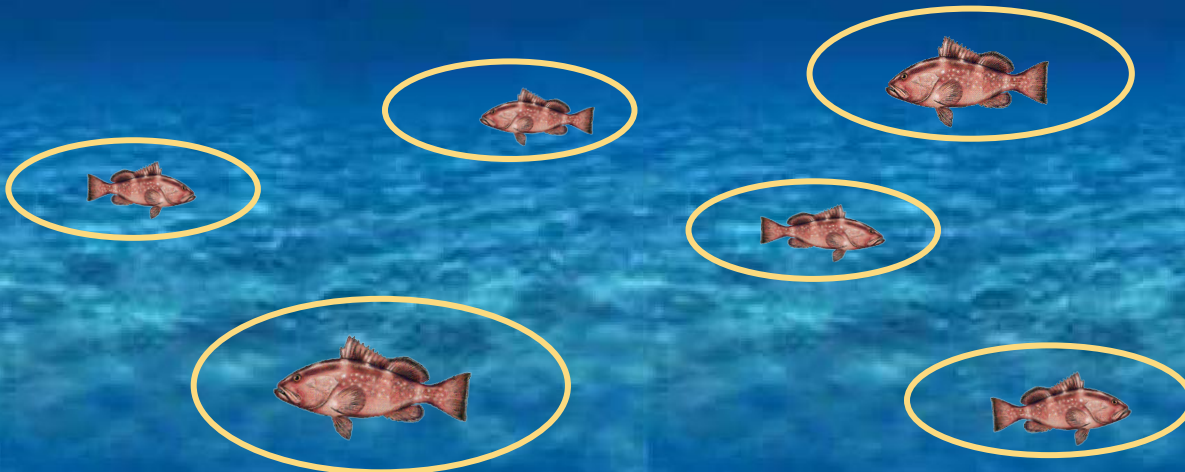
Reducing bycatch in the reef fish bottom longline fishery



Roving Foragers



Reef Fish
Sedentary Foragers





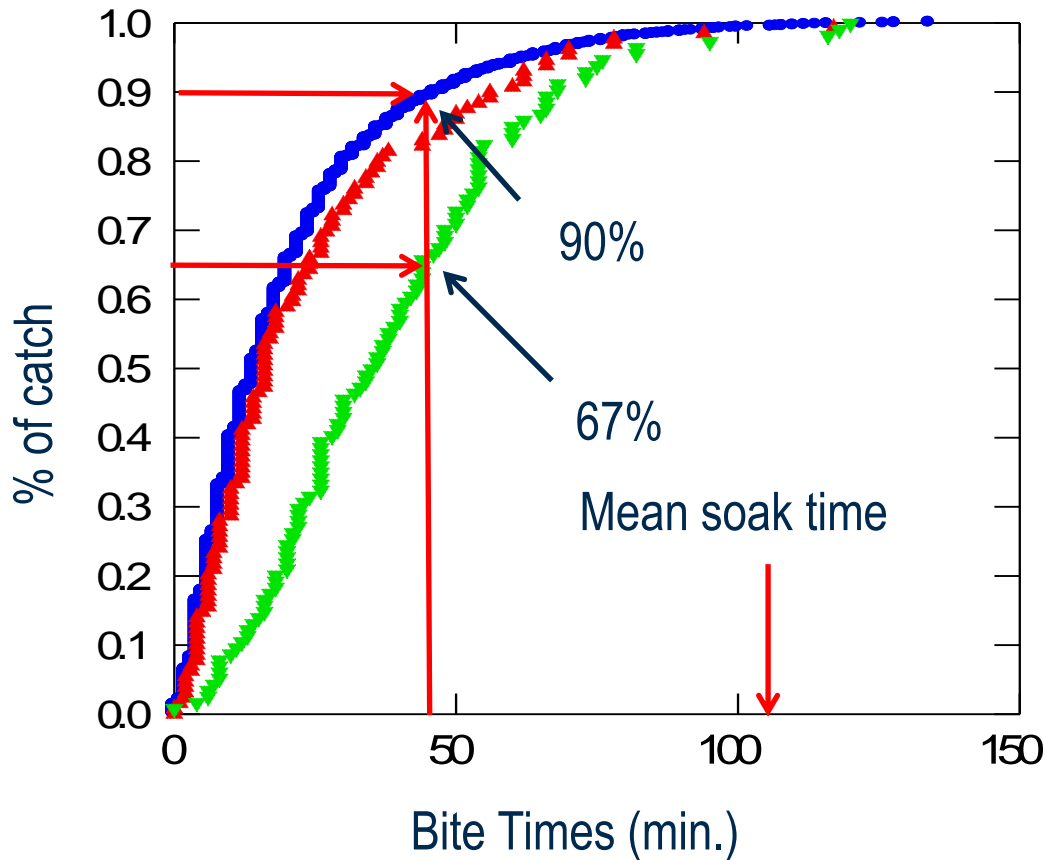
Elapsed Time (Hook Timer)





Bite Times

Reef Fish vs. Sharks



Shorter soak time
reduces bycatch

GROUP

- RED GROUPER
- ▲ RED SNAPPER
- ▼ SHARK



NEFSC Gear Research

Fishery	Species	Research
Trawls (Flounder & Scallop)	turtles	TEDs, Topless trawls, data loggers
Gillnet	sturgeon	Low profile and stand-up gillnets
Gillnet	turtles	Low profile gillnets
Scallop dredge	turtles	Chain mats and deflector dredge
Pound net	turtles	Modified leader
Longline	cusk	assessment of barotrauma



Collaboration with NEFSC Gear Research Program: *Scallop Fisheries*

Assisted NEFSC with initial evaluations of industry developed scallop dredge and modified TEDs to reduce turtle bycatch





Collaboration with NEFSC Gear Research Program: Flounder TEDs



- Participated in flume tank testing
- Assisted in rigging and training of TED installation
- Conducted small turtle certification for flounder TEDs





Future collaborations with NEFSC

- Fall/Winter 2015
- Fishery-dependent
- Flexible cable TEDs
- Mid-Atlantic croaker and flounder testing for catch retention





**Loggerhead
Hatchlings**



**Loggerhead
Yearlings**



**Juvenile to sub-adult
Loggerheads**



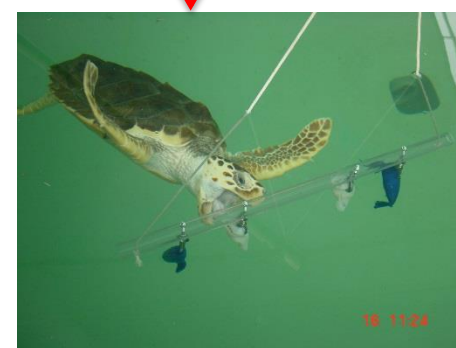
**-Toxicology
-Observer Training**



**- Health Assessment
- Pharmacokinetic Studies**

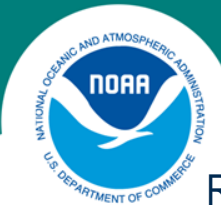


-TED certification



**-Longline Bycatch Mitigation
-Sensory Biology Research**

Primary collaborators: The Institute of Environmental and Human Health, The University of Hawaii/JIMAR, The Houston Zoo, Inc.



Raceways & leatherback filtration system



Water treatment
Includes mechanical
& biological filters
+ protein skimming
with ozone and U/V
Sterilization

Circular turtle rearing tanks



Water chiller units





Turtle buildings



Flow-through seawater basins with 2 year-old loggerheads

PANAMA CITY LAB FACILITIES



Sea turtle “conditioning pens”



SEFSC Gear Research

Successes

TEDs – shrimp fishery

- 97% effective in reducing turtle captures in shrimp trawls
- No effect on target catch rates with optimal TEDs
- International adoption of technology

TEDs – flounder fishery

- Specialized TED minimized catch loss and 97% turtle exclusion

Circle Hooks

- Significant reductions in turtle interactions in NED fishery
- Fishery closure prevented
- Increased swordfish catch rates



SEFSC Gear Research

Limitations

Permitting

- Limits fishery-independent directed research

Commercial vessel charters

- Contracting process overwhelming for owner/operators
- 1-yr lead time for contracts: difficult with temp. funds

Industry participation

- Controversial issues can effect active involvement
- Researchers act as agency liaisons on bycatch issues
- Improved communication: agency management to industry



SEFSC Gear Research

Recommendations and Improvements

Early and sustained communication and planning

- SERO – Researchers – Industry – State agencies

Enhanced research collaborations

- International researchers
- Expansion of NMFS BREP: promote internal collaborations

Fiscal re-allocations

- Funding streams often conflict with fishing seasons
- Increased ability to carry over research funds needed